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ESTIMATES OF SOVIET SCIENTIFIC-TECHNICAL MANPOWER

1. Introduction

The following material is a summary of estimates, made to date in OSI, on Soviet scientific-technical manpower. This summary compares the numbers of persons, in the Soviet Union and in the United States, in groups related to scientific research and development, and scientific education. The numerical estimates are qualified briefly by descriptive material.

2. Table of comparisons

The comparative estimates are contained in the following table. The data are for mid 1953 and are in thousands.

Group / Subject Category	Soviet Union			United States		
	Graduates *	Kandidats	"Scientific Workers" *	Graduates	PhD's + ScD's	"Scientific Workers"
Physical Sciences	570 (545)	28	85 80	525	30.3	185
Agricultural Sciences	200 (195)	10	100 (28)	150	10.2	55
Health Sciences	280 (290)	12	42	360	7.5	
Total	1050 (1030)	50	185 150	1035	48.0	240

* Amended 22 April 1954

3. Groups and Categories

The groups compared in the above table are the following.

(1) Graduates of higher educational institutions (colleges and universities) engaged in scientific and technical fields.

We believe that recent and current graduates of Soviet higher educational institutions in most scientific fields, compare with those graduating from American colleges and universities. However, Soviet educational standards in the early and mid thirties were comparatively low and the average quality of the Soviet graduates is probably still below that of the United States.

(2) Persons with advanced degrees in scientific and technical fields.

The advanced degrees, the holders of which are numerically compared, are the Soviet Kandidat and the American PhD (in which SoD has been included).

In terms of formal requirements, which include 3 years of post-graduate study and a thesis, the Soviet degree of Kandidat is the near equivalent of the PhD. Qualified comparative evaluations of these degrees are too few as yet to modify this provisional appraisal.

(3) "Scientific Workers"

The term "Scientific Worker" is used to describe two classes of persons, both of which consist of graduates of higher educational institutions (colleges and universities).

(a) Those engaged as teachers and teacher-researchers in scientific and technical subjects in higher educational institutions.

(b) Those engaged solely in research in research institutes or laboratories. Engineers, technicians, and others are excluded from this category unless they are doing work classed as "research". Between such fields as production engineering and research engineering divisions are often obscure and thus somewhat arbitrary. It is not always sure if the criteria selected to define "Scientific Workers" in the United States are the same as those used in the U.S.S.R. Consequently the category of "Scientific Workers" is less precise than the two previously used--graduates, and holders of higher degrees.

In several of the graphs which follow, the subject categories - physical sciences, agricultural sciences, and health sciences - are used. They are most convenient because they are the categories regularly used in Soviet literature.

The scientific and technical fields regularly contained in these categories are as follows:

(1) Physical Sciences

Physics
Chemistry
Mathematics
Metallurgy
Engineering (aeronautical, chemical, civil, electrical, mechanical, etc.)
Astronomy
Meteorology
Geology and geography
Other fields based on physics, chemistry or the earth sciences.

(2) Agricultural Sciences

Agriculture (agronomy, animal husbandry, forestry, entomology, etc.)
Biological sciences other than those included under "Health Sciences".

(3) Health Sciences

Medicine and Medical Sciences
Dentistry and Dental Sciences
Other fields supporting health and sanitation (excluding nursing unless based on 4-year curricula)
Biological sciences other than those included under "Agricultural Sciences".

In the graphs for the United States, "Biologists" are divided equally between "Agricultural Sciences" and "Health Sciences". This division is based upon information for PhD's. Of graduates in the categories - Biology, Agriculture and Health - only about one-third are in Biology.

4. Reliability of data

a. General

In dealing with scientific manpower statistics where categories lack precision exactness cannot be expected. The data for both the Soviet Union and the United States are in places either estimated or incomplete. During recent years, for the Soviet Union, data became increasingly scarce, while, for the United States, often the reverse is true. In most comparisons, uncertainties of about ten percent are not unlikely.

The data used in the calculations for the U.S.S.R. are drawn from open Soviet literature - statistical year books (before 1940), journals and newspapers.

The following considerations support the general reliability of these data:

(1) Pre-war data are taken largely from comparatively detailed statistical compilations published for the Soviets own use in planning.

(2) Data since the war, while generally increasingly scarce, are consistent with pre-war trends.

(3) Scarcity of data itself indicates the restriction of information by withholding rather than falsification.

(4) Classified data for 1941, seized by the Germans and later published, agreed well with the information which had appeared in open publications.

All of the data for American graduates and holders of the PhD degree were furnished by the Commission of Human Resources and Advanced Training of the National Research Council. The data for American "Scientific Workers" was furnished by the Resources Division of the Research and Development Board.

b. Graduates

The Soviet figures are based upon a combination of:

(1) Scattered references to numbers of Graduates employed at given times, in the various fields.

(2) fairly good data on the numbers graduating each year in the various fields.

(3) some information on rates of attrition from the professional fields.

The information of these three types fits together quite consistently. The resulting estimates on Soviet Graduates are more firm than those for Kandidats or "Scientific Workers". In fact they are possibly as accurate as the data on American Graduates, as these too, are estimates. (These latter agree quite well with estimates based upon the last census which, for various reasons, cannot be applied directly).

c. Holders of Higher Degrees

Strictly speaking, the computations are for employed Kandidats and living PhD's, 70 years of age and under, but in these groups the numbers employed are probably close to the numbers living.

The total number of Kandidats in 1953 (59,000 in all fields, including non-scientific) was derived from previous total figures for 1946 and 1950 by an extrapolation based upon recent rates of award of the Kandidat degree and an assumed rate of attrition.

The breakdown of the Kandidats into the three subject categories is based on a breakdown for 1947. The 1947 data, however, applied only to persons employed in higher educational institutions - around half of the total. Thus, to arrive at the 1953 breakdown, it was necessary, using suitable assumptions, first to expand the 1947 figures to include Kandidats employed outside higher educational institutions and then to apply the resulting ratios to the 1953 total.

d. "Scientific Workers"

Before attempting a breakdown of the Soviet "Scientific Workers" it was necessary to estimate their total number. Data on total numbers were fairly complete through 1939 but have been sporadic since then - (about three rather vague totals since the war). However, the post-war rates of growth of "Scientific Workers" which these data imply are reasonable from the point of view of the numbers which have been graduating from the non-specialized Soviet Universities. These institutions are the primary source of "Scientific Workers".

Although Soviet sources have given breakdowns for "Scientific Workers" in higher educational institutions as late as 1947, they have released practically no data on "Scientific Workers" in purely research institutions since before the war. Consequently it was necessary, in preparing the above table, to first estimate the breakdown of "Scientific Workers" in research institutions. This was done for 1947 by extrapolation from earlier data and by analysis of trends in the available breakdowns within higher educational institutions. The resulting estimated breakdowns by scientific field were then applied to the previously estimated total number of Soviet "Scientific Workers" in mid 1953.

Obviously the calculations for Soviet "Scientific Workers" just outlined are liable to errors. However, such errors as these are not alone to be feared in comparing numbers of Soviet and American "Scientific Workers". Differences in the Soviet and American criteria for "Scientific Workers" are likely to be more serious. The number of American "Scientific Workers" in the physical sciences seems disproportionately high, not only compared to the number in the same Soviet category but also in regard to the relative numbers of American Graduates and PhD's in the physical sciences. It is possible that high defense spending (amounting to about a half of all U.S. research and development costs) can account for this unexpectedly high number of "Scientific

Workers" in the physical sciences. But it is also possible that the American category includes persons of a type excluded from the same Soviet category.

5. Conclusions

Specific conclusions based upon comparisons of separate Soviet and American sub-groups should be regarded cautiously. They call for more detailed investigations of the quality of the sub-groups and of possible significant differences in the use of Soviet and American personnel in their different environments. However, the foregoing data do indicate that, in general terms, in over-all size, composition and quality, Soviet scientific-technical manpower is similar to that of the United States.

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